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Sucker-Root Relationships in Aspen

by

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Introduction

In northern Ontario aspen (*Populus tremuloides* Michaux) regeneration often occurs prolifically after harvesting hardwood or mixed conifer/hardwood stands in which aspen is a component. Most aspen regeneration is comprised of root suckers developing from the residual root systems of the parent trees. Studies conducted in northern Minnesota and central and southern Ontario have indicated that suckers originate predominantly from roots 0.75 to 1.75 cm in diameter with most occurring on roots within the upper 7.5 cm of the ground surface. Many are on roots within the upper 3.8 cm of the ground surface. These studies also indicated that aspen roots are predominantly in the diameter range of 0.75 to 2.5 cm. They extend radially from the parent stem, close to the surface, with only a gradual change in diameter (Sandberg and Schneider 1953, Horton and Maini 1964). Similar information, specific to northern Ontario conditions, has not been previously ascertained. There is though a need for such information because of the regeneration implications of the vulnerability of aspen roots to disturbance by today's many and varied harvesting and site preparation techniques. In this study the relationships between the incidence and height growth of aspen suckers and the diameter and depth of the roots from which the suckers developed were examined.

Study Area and Methods

The study was located about 15 km northwest of Manitouwadge, Ontario on two cutovers on the American Can of Canada Limited forest concession. The soils of the study area are generally gray wooded and are developing on calcareous deposits of lacustrine clay and silt. The soil texture within the specific areas sampled varied from silty clay loam to clay with a soil moisture regime (Hills 1952) estimated at 3 (very fresh) to 4 (moderately moist). The parent stands were mature mixedwood forests that originated about 1850. Stand composition was primarily aspen with a minor component of white spruce (*Picea glauca* (Moench) Voss), black spruce (*Picea mariana* (Mill) B.S.P.), balsam fir (*Abies balsamea* (L.) Mill), jack pine (*Pinus banksiana* Lamb.), white birch (*Betula papyrifera* Marsh) and balsam poplar (*P. balsamifera* L.). The stands were clearcut during the period late summer 1974 to early spring 1975. Wheeled skidders were used for forwarding tree lengths to slasher sites. Aspen suckering occurred during the 1975 growing season.

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In late August 1975, a 90 m x 90 m study area in each of the two cutovers (Stands A and B) was divided into a 9 x 9 grid from which 16 sampling points were randomly selected. At each sampling location, eight aspen stems closest to points 1 m from the main sampling point were selected for examination; one stem on each 45° radii. One hundred and twenty eight stems per cutover were thus selected for root excavation. The height of each stem, the diameter of the parent root at a constant 5 cm from the stem (always on the smallest of the two diameters present on opposite sides of the stem) and the depth from the ground surface to the top of the parent root were measured. Observations were also made on the soil material in which the parent root was located: litter, humus or mineral soil. Additionally, for stand descriptive purposes, regeneration density was determined by stem counts on 80 randomly located 1 m x 1 m quadrats in each cutover area. Root ages were not determined.

Results

The first growing season after cutting the average density of aspen regeneration in Stands A and B was approximately 70 000 and 55 000 stems/ha with average total heights of 70 and 61 cm respectively. All stems sampled were root suckers; no seedlings were encountered.

The relationship between depth of parent root and sucker frequency is illustrated in Figure 1. An obvious curvilinear trend between root depth and sucker occurrence is displayed with sucker occurrence declining as root depth increases. Within this relationship for Stands A and B respectively, by grouped depth classes, roughly 80% and 90% of the excavated suckers developed from roots within the top 5.9 cm of the ground surface.

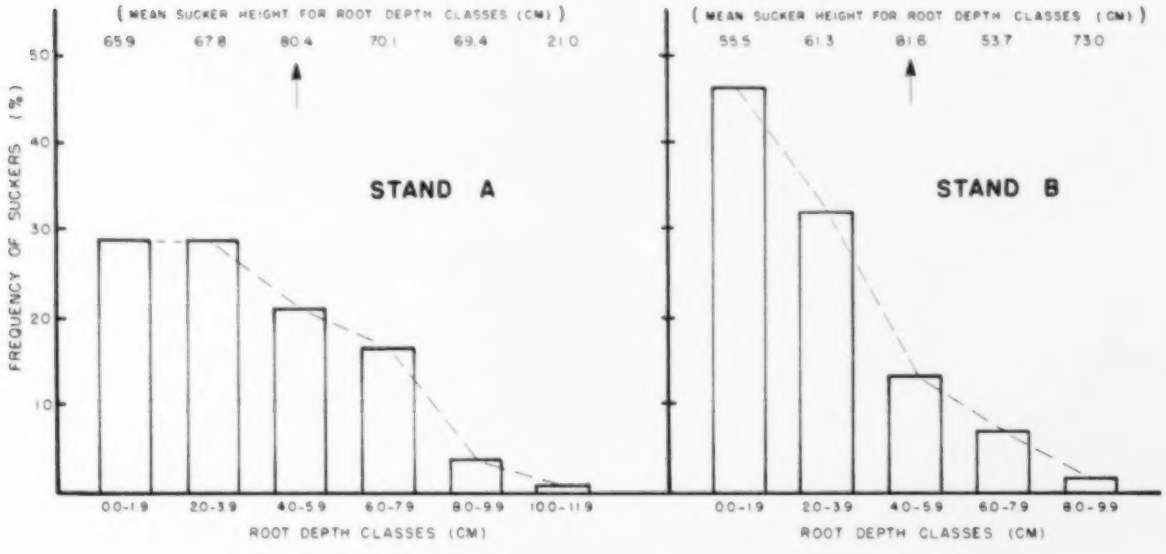

Figure 1 Relationship between sucker frequency, sucker height and parent root depth.

Over both cutovers the litter and humus layers combined averaged 6-8 cm in depth and most of the suckers developed within these layers. Only 2 and 8 percent respectively of the suckers developed from roots in the mineral soil layers of Stands A and B.

For first year height growth, by regression analysis, there was no significant relationship between the parent root depth and subsequent height development (P=0.05; Stand A: r=0.06; Stand B: r=0.15). While not statistically significant, a trend consistent for both stands is suggested for maximum average height growth to occur from roots at depths from 4.0 - 5.9 cm. Height growth was generally less from either shallower or deeper roots (Fig. 1).

The relationship, again curvilinear, between sucker incidence and parent root diameter is shown in Figure 2 with sucker occurrence decreasing with increasing root diameter. In general, by grouped diameter classes, approximately 80 and 85 percent of the stems examined in Stands A and B respectively occurred on roots with diameters smaller than 1.5 cm.

Regression analysis indicated that there were no obvious relationships between sucker height and parent root diameter (P=0.05; Stand A: r=0.27 and Stand B: r=0.10). Here too, the data tentatively suggest for both stands that the tallest stems occurred on roots from 0.5 to 1.9 cm in diameter with shorter stems occurring on smaller or larger roots (Fig. 2). In Stand A this suggested relationship is obscured for the larger diameter classes by the limited stem occurrence.

Of all the sucker producing roots examined in the two areas there was no significant relationship between parent root depth and root diameter (P=0.05; Stand A: r=0.02; Stand B: r=0.11).

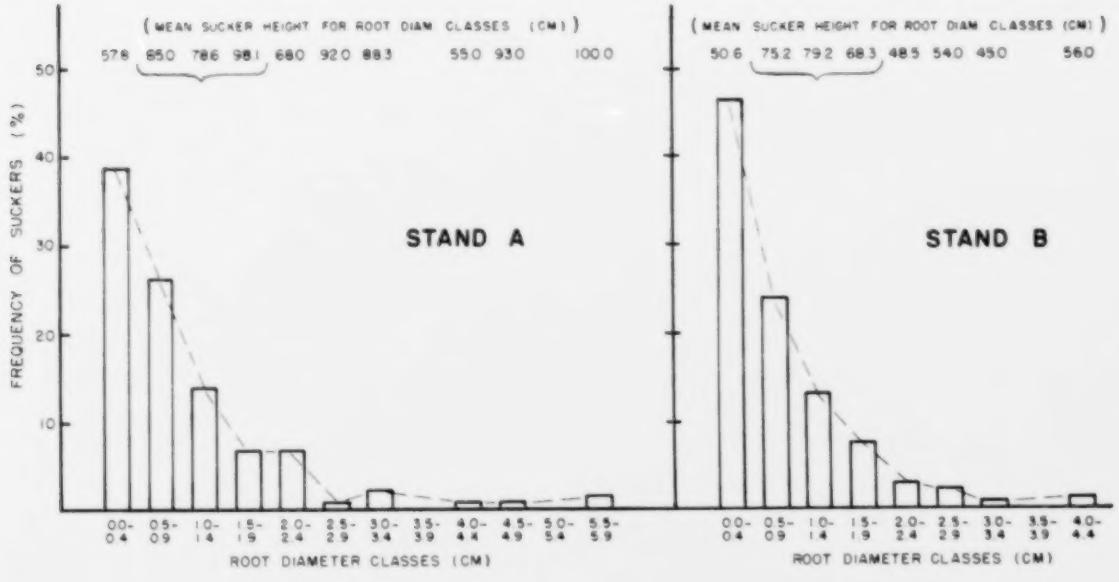

Figure 2 Relationship between sucker frequency, sucker height and parent root diameter.

Conclusions

This study has verified that in northern Ontario, for at least the two cutovers examined, similar aspen sucker-parent root relationships exist as they do in other areas of the species range. The frequency of occurrence of aspen stems as influenced by the size and depth of parent aspen roots is well within the ranges determined for northern Minnesota and central and southern Ontario. For aspen management in northern Ontario the importance of sucker-producing roots, with their high natural potential for vegetative reproduction and their consistent occurrence in the shallow organic layers of the soil, is magnified wherever harvesting and silvicultural treatments would change the root containing status or the thickness of the organic layers. It is known that for extensive management, treatments such as clearcutting, mechanical scarification or prescribed burning can be used to induce aspen regeneration (Zillgitt 1951, Perela 1972, Kemperman 1976). A more complete knowledge of sucker-root relationships will lead to a better understanding of the results of silvicultural trials involving aspen. These relationships will be important components of intensive management systems for northern Ontario.

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